

M353 Tutorial/Lab 3 (S. Zhang) .

1. Compute the sum

$$s = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{100}$$

in this order and in the reversed order. Find the difference.

```
format long
n=100
sum=0;for i=1:n, sum=sum+1/i; end, sum
sum2=0; for i=n:-1:1,
    sum2=sum2+1/i; end, sum2
diff=sum-sum2
```

2. (260) Compute the sum

$$s = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{10000}$$

in this order and in the reversed order. Find the difference.

M353 Tutorial/Lab 4 (S. Zhang) .

1. Do 4 steps of the fixed-point iteration for solving the equation
- $x = g(x)$
- , where

$$g(x) = 1 + x - x^2/4.$$

Let $p_0 = -2.05$.

```
g=inline('1+x-x^2/4');
x=-2.05; x=g(x),x=g(x),x=g(x),x=g(x),
```

2. (262) Do 4 steps of the fixed-point iteration for solving the equation
- $x = g(x)$
- , where

$$g(x) = 1 + x - x^2/4,$$

Let $p_0 = 1.6$.

M353 Tutorial/Lab 5 (S. Zhang) .

1. Do 3 steps of the bisection iteration for solving the equation

$$f(x) = -x^2 + 2.3x, \quad [1, 3]$$

Answer:

```
format short
f=inline('-x.^2+2.3*x');
x=[1 3]; bis=[x f(x)];
for i=1:3
c=(x(1)+x(2))/2;
if(f(c)*f(x(1))<0) x(2)=c;
else x(1)=c; end
bis=[bis; x f(x)]
end
```

2. (263) Do 3 steps of the bisection iteration for solving the equation

$$f(x) = -x^3 + 3.3x, \quad [1, 3]$$

M353 Tutorial/Lab 6 (S. Zhang) .

1. Find the iterates
- p_2
- to
- p_5
- for both the method of False Position and the secant method.

$$x^2 - 4x + 1 = 0, \quad p_0 = 2, \quad p_1 = 5.$$

Submit the data only.

```
f=inline('x.^2-4*x+1'); p0=2;p1=5;
sc=[p0 p1]; fp=[p0 p1];
for i=1:5,
p2=p1-f(p1)/((f(p1)-f(p0))/(p1-p0));
p0=p1;p1=p2;
sc=[sc p2]; end, sc
p0=fp(1); p1=fp(2);
for i=1:5,
p2=p1-f(p1)/((f(p1)-f(p0))/(p1-p0));
if(f(p2)*f(p1)>0),p1=p2;else p0=p2;end
fp=[fp p2]; end; fp, [sc' fp']
x=0:0.1:5.1;
plot(x,f(x),x,0*x,sc, f(sc),'x',fp,0*fp,'o')
legend('f', '', 'secant', 'FPM')
legend('Location', 'northwest')
```

2.0000	2.0000
5.0000	5.0000
3.0000	3.0000
3.5000	3.5000
3.8000	3.6667
3.7273	3.7143
3.7320	3.7273

Note that first 4 iterates are same.

2. (264) Find the iterates
- p_2
- to
- p_5
- for the secant method.

$$x^2 - 5x + 4 = 0, \quad p_0 = 2, \quad p_1 = 6.$$

Submit the data only.

M353 Tutorial/Lab 7 (S. Zhang) .

1. Find the iterates
- p_2
- to
- p_5
- for both the method of False Position and the secant method.

$$x^2 - 4x + 1 = 0, \quad p_0 = 2, \quad p_1 = 5.$$

Submit the data only.

```

f=inline('x.^2-4*x+1'); p0=2;p1=5;
sc=[p0 p1]; fp=[p0 p1];
for i=1:5,
p2=p1-f(p1)/((f(p1)-f(p0))/(p1-p0));
p0=p1;p1=p2;
sc=[sc p2]; end, sc
p0=fp(1); p1=fp(2);
for i=1:5,

p2=p1-f(p1)/((f(p1)-f(p0))/(p1-p0));
if(f(p2)*f(p1)>0),p1=p2;else p0=p2;end
fp=[fp p2]; end; fp, [sc' fp']
x=0:0.1:5.1;
plot(x,f(x),x,0*x,sc, f(sc), 'x',fp,0*fp, 'o')
legend('f', '', 'secant', 'FPM')
legend('Location', 'northwest')

```

2.0000	2.0000
5.0000	5.0000
3.0000	3.0000
3.5000	3.5000
3.8000	3.6667
3.7273	3.7143
3.7320	3.7273

Note that first 4 iterates are same.

2. (265) Find the iterates p_2 to p_5 for the secant method.

$$2x^2 - 10x + 7 = 0, \quad p_0 = 3, \quad p_1 = 5.$$

Submit the data only.

M353 Tutorial/Lab 8 (S. Zhang) .

1.

$$A = \begin{pmatrix} 7 & 2 & 2 \\ 2 & 12 & 8 \\ 2 & 1 & 17 \end{pmatrix}, b = \begin{pmatrix} 14 \\ 24 \\ 34 \end{pmatrix}$$

Find, by MATLAB, $\det A$, A^{-1} , $A \setminus b$, $A^{-1}b$, and LU -decomposition of PA (row pivoting).

```

format long
A=[7 2 2; 2 12 8; 2 1 17],
b=[ 14 24 34]
detA=det(A)
invA=inv(A); invA=A^(-1)
solx=A\b
solx=invA*b
[ L U P]=lu(A)

```

2. (266)

$$A = \begin{pmatrix} 2 & 3 & 4 \\ 4 & 4 & 11 \\ 6 & 13 & 8 \end{pmatrix} \quad b = \begin{pmatrix} 7 \\ 22 \\ 9.1 \end{pmatrix}$$

Find, by MATLAB, $\det A$, A^{-1} , and the solution $Ax = b$.

M353 Tutorial/Lab 9 (S. Zhang) .

1. Let

$$(A|b) = \left(\begin{array}{ccc|c} 2 & 1 & 1 & 3 \\ -6 & 1 & 2 & -5 \\ 4 & -3 & 4 & 1 \end{array} \right).$$

Solve the system by Gaussian elimination with partial pivoting. You need to submit all matrices after each row switching.

```

A=[2 1 1 3; -6 1 2 -5; 4 -3 4 1],
p=1;q=2;
a=A(p,:); A(p,:)=A(q,:); A(q,:)=a
A(2,:)=A(2, :)+(-A(2,1)/A(1,1))*A(1, :);
A(3,:)=A(3, :)+(-A(3,1)/A(1,1))*A(1, :);
p=2;q=3;
a=A(p,:); A(p,:)=A(q,:); A(q,:)=a
A(3,:)=A(3, :)+(-A(3,2)/A(2,2))*A(2, :);
x=A(:,1:3)\A(:,4)

```

-6.0000	1.0000	2.0000	-5.0000
0	-2.3333	5.3333	-2.3333
0	0	4.7143	0.0000

2. (302) Let

$$(A|b) = \left(\begin{array}{ccc|c} 2 & 2 & 1 & 3 \\ -2 & 8 & 2 & -5 \\ 7 & -3 & 4 & 1 \end{array} \right).$$

Solve the system by Gaussian elimination with partial pivoting. You need to submit all matrices after each row switching.

M353 Tutorial/Lab 10(a) (S. Zhang) .

1. Find $\|A\|_\infty$, $\text{Cond}(A)$ and an x such that $\|x\|_\infty = \|A\|_\infty \|x\|_\infty$

$$A = \begin{pmatrix} 7 & -7 \\ -3 & -15 \end{pmatrix},$$

```

A=[7 -7;-3 -15]; x=[-1 -1]';
Anorm=norm(A,inf), CondA=cond(A,inf),
xnorm=norm(x,inf),
[Anorm*xnorm, norm(A*x,inf)]

```

18	3.1429
	1
18	18

2. (303) Find $\|A\|_\infty$, $\text{Cond}(A)$ and an x such that $\|x\|_\infty = \|A\|_\infty \|x\|_\infty$

$$A = \begin{pmatrix} 7 & 1 & -7 \\ 3 & 14 & 1 \\ 5 & 3 & -15 \end{pmatrix},$$